



European Patent Office

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	5
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	---

(11)

EP 0 731 203 A1

(12)

EUROPEAN PATENT APPLICATION

(51) Int. Cl.⁶: **D06F 58/24**, **D06F 39/14**

(21) Application number: 95202389.3

(22) Date of filing: 05.09.1995

(72) Inventor: Fumagalli, Silvano
I-20052 Monza, Milano (IT)

(30) Priority: 09.03.1995 IT MI950452

(74) Representative: Falcetti, Carlo et al
c/o JACOBACCI & PERANI S.p.A.
Via Visconti di Modrone, 7
20122 Milano (IT)

(71) Applicant: **CANDY S.p.A.**
I-20052 Monza (Milano) (IT)

(54) **A condensation laundry dryer with arrangements for collecting condensation water in a container**

(57) A laundry dryer of the household type having a top-loading rotating drum and condensation water collecting arrangements, wherein an openable top cover (2) for loading the machine forms an inner volume for containing the condensation liquid. In a first embodiment, the condensation liquid is admitted into a tank (5) received in the inner volume of the cover for removal through a front opening (4) of the cover (2) when the cover is partly opened; in a second embodiment, the cover (2) itself forms a condensation liquid collecting tank and is removably hinged to the machine body.

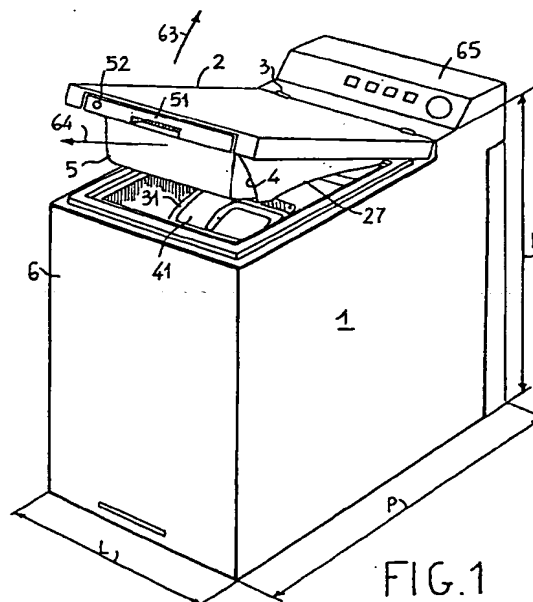


FIG. 1

EP 0 731 203 A1

Description

This invention relates to a laundry dryer for household use, being of the top-loading type with arrangements for collecting condensation water in a container.

Known are condensation laundry dryers which do not require to be installed close to a water system connection, and which usually have some rinse, cooling or condensation water draining arrangements associated therewith, since steam (not to be released to the environment) is caused to condensate from the drying process therein by a stream of cooling air.

Such machines include of necessity a condensate collecting tank whose capacity is at least equal to the volume of condensate produced by one drying cycle when in maximum load conditions and which requires to be emptied periodically, so that it must be provided detachable.

Several alternative constructions have been proposed and used. In many instances the tank has been placed in the lower area of the laundry dryer at a lower level than the condenser, such that the condensation water would flow into the collecting tank by gravity without pump assistance.

The tank is taken out through a front door in the machine by a horizontal sliding movement.

This solution is economical but has some disadvantages: the tank is awkward to remove, from an ergonomic standpoint, and is not safeguarded against spillage when overfilled.

While the problem may be overcome by having the level of fill displayed, a visual check of the level would still be inconvenient to effect.

Viable automatic arrangements for monitoring the filled up and overflow state would be expensive and additional to the protection arrangements already made to ensure the laundry dryer general operability.

A further disadvantage comes from the liquid being possibly spilled out of the condensation water collecting tank housing compartment, open to the front.

Front loading laundry dryers have also been provided with the tank placed in the upper area of the machine, inside an open front compartment whence the tank can be slid out. This does make for easier tank handling and water level checking, but is at clash with the consumer's aesthetic demands and cannot provide full protection against overflow and spillage, just as when the tank is installed in the lower area.

Furthermore, top loading machines, i.e. machines having no front doors, have been proposed which have the tank placed between the machine top cover and the rotating laundry-drying basket.

This is an attractive solution, but has a drawback in that a large proportion of the tank surface is left exposed to the heated, relatively moisture-laden air which would surround the basket in the event of the drying circuit being made less than perfectly tight. This surface is bound to act as a particularly active condensing surface and to significantly degrade the machine efficiency.

Since the tank undersurface next to the dryer drum is cylindrically concave, the risk exists of an amount of condensate building up by gravity in the lowermost area thereof, with the result that water may drip onto the drum and be scattered around the dryer body interior to initiate corrosive processes on any inadequately protected metal and electric parts.

From the engineering standpoint, moreover, it is necessary that the tank be provided with automatic closure tight fittings for connection to a condensate delivery line.

Another drawback of this approach is that, with the tank accommodated inside, its fill level cannot be checked from the outside, this operation requiring that the cover be lifted up.

And even so, the level is difficult to reveal conveniently.

Finally, the limited room available cannot be exploited to its best, because for strength reasons, the flat cover must be a significant thickness and formed of an outer cover and inner cover separated by a suitable gap in the 2 to 3 cm range.

This volume may amount to a few liters, and represents an unnecessary waste.

The present invention obviates all these drawbacks and provides a top loading laundry dryer with collecting tank for the condensation water, wherein the cover interior itself functions as the condensation liquid tank.

In a first embodiment, the cover is hinged fixedly to the laundry dryer body and acts as a housing for a collecting tank which can be slid into and out of the housing by opening the cover a crack and moving the tank toward the front of the laundry dryer.

In a second embodiment, the cover itself functions as a collecting tank and is hinged detachably to the laundry dryer body. In either instances, the cover is hinged conventionally near the upper rear corner edge of the body, ahead of the control panel.

According to a further aspect of the present invention, the laundry dryer is provided with a valving system for admitting condensation liquid into the tank, whether the latter is formed integral with the cover or housed removably within the cover.

The valving system is conveniently constructed to cut off any flow of condensate to the tank/cover if the latter is not there or the cover is not properly closed.

This in order to provide for the apparatus maximum protection against any leakout of liquid.

According to a further aspect of the present invention, the valving system is mounted in a gutter for catching any overflowing liquid or condensation dewdrops and recirculate them to the condensation circuit. The gutter provides double protection additionally to that provided by the valving system against any liquid spill to the machine interior. The gutter is conveniently formed in the handhole bezel with which top loading dryers come inherently equipped.

According to a further aspect of the present invention, the tank/cover is provided with an internal intake

conduit which is open at the top and communicated to the outside at the bottom for its connection to the valving system, and with an internal overflow conduit which also is open at the top and communicated to the outside at the bottom to discharge any overflow into the gutter.

According to a further aspect of the present invention, the two intake and overflow conduits are disposed near a front wall of the tank/cover having a cover lifting handle formed therein.

In this way, the partial opening of the cover required for removal or for removing the tank, and consequent change in trim, causes the condensation liquid contained in the sliding tank to be displaced to the rear of the tank/cover, away from the intake and overflow conduits, thereby eliminating all risks of spillage in handling the tank.

In addition, with the removable tank, the handle serves the dual functions of permitting the cover to be lifted up and the tank pulled out of its housing.

According to a further aspect of the present invention, the cover is closed at the bottom by an inner cover plate having a monotonic downward slope from a rear portion of the machine toward the front thereof, to overlie and partly merge with the overflow gutter, thereby directing and collecting in the gutter any condensate which may have formed on the bottom face of the inner cover plate.

According to a further aspect of the present invention, to enhance drying efficiency and reduce the condensing phenomena over the interior walls of the dryer, the drum loading door is provided with a resilient sealing gasket.

The features and advantages of the present invention will become apparent from the following description and the accompanying drawings, in which:

Figure 1 is an overall perspective view of a first embodiment of a laundry dryer according to the present invention;

Figure 2 is a functional diagram of the architecture of the laundry dryer in Figure 1;

Figure 3 is a fragmentary front-to-rear section view of the laundry dryer in Figure 1;

Figure 4 is a sectional view along A-A in Figure 3 of a modified embodiment of the laundry dryer in Figure 1;

Figure 5 is a front-to-rear section view of a preferred embodiment of a tank fill valving system for the laundry dryer in Figure 1;

Figure 6 is a sectional view of the tank along B-B in Figure 5;

Figure 7 is a fragmentary front-to-rear section view of a second embodiment of the laundry dryer according to the present invention;

Figure 8 is a fragmentary section view of the embodiment in Figure 7 taken along C-C in Figure 7;

Figure 9 is an exploded perspective view of a preferred embodiment of a releasable hinge bond for the laundry dryer of Figure 7.

Referring to Figure 1, shown therein is an exploded overall perspective view of a laundry dryer embodying this invention.

The dryer is compact in size and comprises a box-type body 1, generally of enamelled sheet metal, in the form of a right parallelepipedon having a depth P, illustratively of 60 cm, height H of 85 cm, and width L of 40 cm.

Depth and width refer to the normal conditions of installation and use anticipated for the machine.

The box-type body 1 is closed at the top by a cover 2, which can be swung open about a hinge 3 located near the rear corner edge of the body, on which a known control and program panel 65 locates. The cover is shown in its half-opened position.

The box-type body conventionally accommodates a cylindrical drum 31 rotating about a horizontal axis and being provided on its periphery with an unlockable door 41, accessible by opening the cover 2, through which laundry is introduced into the rotating drum or basket for drying.

The drum has a diameter and an axial length such that most of the box-type body inside volume is occupied by the drum which, for easy introduction of the laundry, should be placed with its peripheral top as close as possible to the cover. A generally wedge-shaped receiver pouch is formed in the cover thickness which is open forwardly and closed downwardly by an inner cover 27 which extends into the box-type body down to a suitable depth limited by the space requirements of the rotating drum.

In a first embodiment of the invention, a collecting tank 5 for the condensation liquid is accommodated removably inside the pouch 4.

As explained hereinafter, the pouch 4 and tank 5 are suitably shaped to make best use of the available interior volume of the machine. The tank 5 is suitably provided, on a front edge flush with the front wall 6 of the machine body, with a handle 51 for removing it and a lens 52 or clear window to view its fill level there-through. The cover can be fully opened by a swing movement in the direction of arrow 63, and the tank 5 can be removed with the cover partly open by a movement in the direction of arrow 64.

Mounted in the lower portion of the front wall 6 is a ventilation grid which allows cooling air for an internal condenser to be drawn in (or even blown out).

Alternatively, the suction or ejection could take place through the machine bottom, if held off the floor by rest feet, but with the inflow and outflow substantially separated from each other.

Provided in the lower portion of the box-type body, not shown in Figure 1, are a heat exchanger/steam condenser, a condensation fluid collecting pan, and motive

members for driving rotatively the drum, suction fans and a condensation liquid transfer pump.

Figure 2 shows in block diagram form the construction of the laundry dryer of Figure 1.

A stream of heated air is flowed in a closed loop through the drum 31, it being admitted through a side wall 7 or tympan end of the drum and discharged through the opposite wall 8. The heated air vaporizes the liquid with which the laundry is soaked.

The stream is induced by a fan 9 which directs the moisture-laden warm air into a heat exchanger/condenser 10.

The exchanger is crossed, in counterflow or cross-flow relationship, by a stream of cool air, drawn in from the environment, induced by a fan 11, so that the moist warm air is cooled and moisture condensed in the exchanger.

The moisture-free cool air is introduced, in closed loop circulation, back into the drum 31 after being heated by electric resistance heaters 12, while the heated condensation air is exhausted to the environment.

The condensation liquid which forms in the heat exchanger is discharged to a collecting pan 13, which may be integral with the condenser, and by means of a pump 14 is directed into the collecting tank 5 for the liquid through a safety valve device 53 to be explained.

The operation of the laundry dryer is controlled by a programmer 15 which operates the various electric and mechanical members and detects the liquid level in the pan 13 by means of a pressure switch 16 or an equivalent sensor, to cease operation on the occurrence of anomalous conditions, such as the pan 13 overflowing.

Other safety devices, not shown, e.g. related to the closed state of the cover 2, may be suitably provided.

Advantageously, the inner cover 27 which closes the bottom of the housing 4 for the condensation liquid collecting tank 5 is suitably connected with a terminating drip edge thereof in overlapping relationship to an overflow and condensation dewdrop collecting pan 17 which discharges any overflow and condensate to the pan 13, preferably under a head where the pan 13 is in communication with the air of the drying circuit, through a drain conduit 18.

The importance of the collecting pan 17 and its drain connection 18 to the pan 13 will be explained hereinafter.

In Figure 2, the cover 2 and the tank 5 housed in it are shown in their operating positions.

A dash line indicates the half-open position of the cover and the tank housed in it.

Figure 3 is a front-to-rear sectional view of the upper portion of the washing machine to bring out some of its constructional details.

The box-type body 1 is provided at the top with a handhole bezel 19, preferably a plastics moulding, having at its center a rectangular access slip to provide access to the drying drum, with walls which lead funnel-

like on four sides to a location close to the outer surface of the drum 31.

In the vicinity of the front wall 6, the handhole bezel is sunk into the box-type body to form a gutter 20 for collecting overflow from the tank 5.

The gutter is provided with a drain port 23 which is connected to the condensation liquid collecting pan by a pipe 24.

Hinged to the handhole bezel, on the rearward side thereof, is a cover which closes the box-type body top and the access slip formed by the bezel 19.

Expediently, the cover also is a box-type construction formed of a flat top plate or cover 26 of enamelled sheet metal, and an inner cover 27 of moulded plastics which forms a pouch with an open forward end. The top wall 27A of the pouch is substantially flat and in contact with the cover plate 26 inwardly thereof. The bottom wall 27B of the pouch has a central zone which is sunk into the slip of the handhole bezel, merging with its walls and forming a housing 4 which is rectangular in plan view and open forwardly, for the tank 5 which is inserted therein through the front opening. A dash line 4A shows the outline of the front slip of the housing.

Expediently for reasons to be discussed, the central zone of the bottom wall 27B of the inner cover is inclined with a monotonic downward slope from the rear portion to the front portion.

The front edge of the tank is completed by a molded plastics template 21 which is expediently formed with a handle for opening the cover and taking out the tank. The template 21 merges flush with the top wall of the cover and the front wall.

The drying drum 31 is conventionally provided with a door 41 hinged about a generatrix line 32 of the drum. The door 41 is conventionally provided with an opening handle 33 which also functions as a lock when in the closed position.

Advantageously, but not necessarily, the door 41 is provided with a resilient lip seal 34 to ensure a substantially tight fit of the door 41 to the drum 31.

It will be appreciated from Figure 3 that, with the cover opened, the slip formed by the handhole bezel is freed internally so that the door 41 can be opened to introduce laundry or withdraw dried items from the drum 31, with no need to first remove the tank 5 from its housing in the cover.

The withdrawal of the tank 5 from the pouch housing is particularly ergonomic because the tank can be grasped near the front at standard working surface level.

Before discussing further advantageous expedients contemplated by the invention, it pays to consider some major technical problems solved by the invention.

As previously mentioned, the sides of the drum, mounted for rotation about a center shaft, are perforated near the shaft to admit heated air into the drum and exhaust moisture-laden air from the drum.

The drying air delivery and return channels are connected to the drum by means of seals, preferably laby-

rinth seals, whose fit, if less than perfect, may let out a minimal volume of relatively moist warm air through the seals.

To this, there may add moist air leaking past the loading door 41 to the basket outside.

The relatively moist warm air which surrounds the drum is dragged into rotation by the drum.

Thus, an airflow is created at the drum periphery which generates convective motion in the space between the drum and the cover, within the loading slip.

The pattern of this motion is as indicated by arrows 36, when the drum 3 turns at the top in the direction of arrow 35.

The presence of a condensation liquid collecting tank, at room temperature and with large heat capacity, due to the liquid contained therein, with a cold wall in contact with the convective flow, as proposed by the state of the art, causes dewdrops to form on the tank underside which fall onto the drum during the drying operation and are dragged around by the drum and scattered all over the interior parts of the machine to cause the aforementioned problems. Also, on completion of the drying process, it may cause dripping outside the washing machine as the tank is manipulated for removal.

By contrast, in the embodiment of Figure 3, this problem is substantially obviated by the inner cover bottom wall 27 interposed between the tank and the stream of moist air forming an effective thermal insulation shield which allows the inner cover to become heated by the heat transferred by the convective motion of the air inside the slip, with but minimal leakage to the tank. To this aim, the direct contact of the bottom wall of the inner cover with the tank can be minimized by providing elongate ribs in a front-to-rear direction, for example, either across the wall of the inner cover or that of the tank juxtaposed to it, so that an air space is left therebetween which has a thickness on the order of few millimeters.

It should also be noted that, thanks to the particular shape of the inner cover with the downward sloping bottom wall from back to front, even the slightest formation of dewdrops will tend, by the combined effects of gravity and the mechanical convection action, to move toward the front edge 46 of the bottom wall of the inner cover, suitably shaped like a drip pan, and to fall into the gutter 20 where it is collected. It should be noted that the drip pan 46 also serves an advantageous slip function which facilitates the insertion of the tank into the pouch.

Figure 4 shows a sectional view in the direction of A-A in Figure 3 of an embodiment which achieves the same spacing and interspace formation effect between the inner cover and the tank bottom while enabling the tank 5 capacity to be maximized.

As shown in Figure 4, the tank 5 is provided with two hollow expansion wings 51, 52 which extend along the sides of the tank 5 in line with its top wall. The wings are received within the cover thickness and bear on two

side guides 53, 54 formed in the bottom wall of the inner cover.

In this way, the bottom wall 55 of the tank can be held off the bottom 56 of the housing formed by the inner cover, and the tank capacity be concurrently increased by the volumes of the wings which act as floodplains for tank overfill conditions.

Figure 5 is a sectional view in the machine front-to-rear direction of a preferred embodiment of the intake valving system 53 for filling the tank, and shows in greater detail the relative arrangement of the tank, the inner cover, and the handhole bezel.

Formed in the handhole bezel 19, inwards of the collecting gutter 20, is a cylindrical sleeve 22 having an inside shoulder 25 and being coaxial with a cylindrical sleeve 28 which depends from the gutter 20.

The sleeve 28 is also provided with an inside shoulder 29.

The sleeve 28 receives slidably, axially therein, a tubular element 30 which is closed at its lower end by a plug 35 and extends upwardly into the sleeve 22.

The lower end of the tubular element 30 is provided with a resilient sealing gasket 43, such as an O-ring.

At an intermediate axial location, the tubular element 30 is provided with an outside flange 36 received slidably in the sleeve 22.

A compression spring 37 is accommodated between the tubular element 30 and the sleeve 22, and acts between the shoulder 25 and the flange 36 to bias the tubular element 30 upwards to a rest position defined by the gasket 43 coming into sealing contact with the shoulder 29.

In this position, the annular element 30 acts as a closed shut-off valve for a stream of condensation water directed into the sleeve 28 through a delivery pipe 38.

With the machine cover closed, the bottom wall 27 of the inner cover, which forms the bottom of the housing 4, has its drip-pan front edge 46 facing the gutter 20 and partly exposes the bottom wall of the tank 5 to the gutter 20.

The tank 5 is provided on its interior with a condensation liquid transfer pipe 40 which is aligned axially to the tubular element 30.

The pipe 40 has an open top end near the top wall of the tank 5 and flares out at its bottom end into a coupling flange 41 for glued or thermowelded attachment to the bottom wall of the tank 5, as suitably apertured for inserting the pipe 40 into the tank.

The flange 41 also forms a conical fitting for connection to the upper end of the tubular element 30, which may be suitably provided with a sealing gasket 42.

With the tank 5 properly fitted in its cover housing, and the cover closed, the flange 41 will interfere with the top end of the tubular element 30 and move it a predetermined distance axially downwards against the bias force of the spring 37.

The bottom end of the element 30 is provided with radial openings 44 in its peripheral surface which open into the sleeve 28 interior.

In this way, the tightness of the element 30-to-flange 41 fit is ensured, on the one side, and the shut-off valve opened, on the other side, by the pressure from the spring 37.

It can be appreciated that, absent the tank 5 or with the cover not perfectly closed, the shut-off valve would stay closed.

The tank 5 is provided, additionally to the fill and transfer pipe 40, with an overflow pipe 45, as shown in Figure 6, which also is housed within the tank, with a lower end open into the gutter 20 (Figure 4) and an upper end open into the tank.

The pipe 45, in addition to ensuring a maximum level of fill, provides a compensation vent which prevents the tank 5 from becoming pressurized during its filling or vacuumized during its emptying.

Advantageously as shown in Figure 6, to ensure that the tank can be virtually completely emptied without requiring the provision of removable plugs, the overflow pipe 45 can be disposed in close proximity of a corner edge of the tank formed by one side wall and the front wall of the tank.

This arrangement has a further advantage in that by partly opening the cover and pivoting the tank accordingly, the condensation liquid contained therein is displaced into the rear volume of the tank away from the overflow pipe, thereby removing all risks of spillouts even with the tank in an overfilled condition. In the functional diagram of Figure 2, the partly open position of the cover is shown in dash lines, so as to visually emphasize this effect.

Any spillouts through the overflow pipe 45, with the tank installed in its housing and the cover closed, would fall into the gutter 20 and be discharged into the condensation water collecting pan 13 (Figure 2).

The gutter 20 is also used to advantage for catching any condensation dewdrops formed on the underside of the inner cover 27.

For this purpose, it can be seen in Figure 5 that the bottom plate of the inner cover, sloping monotonically downwards, is terminated in its closest zone to the machine front with a depending rib 46 and received in the gutter 20 which acts as a drip sprinkler and on which any condensation water formed on the underside of the inner cover collects by gravity.

Before taking into consideration other advantageous detailed aspects of the tank, it pays to close with the discussion of some functional aspects mentioned above.

Prior art laundry dryers equipped with a collecting tank have been said to require inherent protection to discontinue the machine operation on the occurrence of an overfill condition of the tank.

To provide this protection, devices have been proposed which are either responsive to the tank weight or the level of the liquid therein to operate warning and

stop electric switches, additional to the protection devices and consisting of the pressure switch 16 (Figure 2) which controls the level of the liquid in the collecting pan 13, perhaps provided integral with the exchanger 10.

In the laundry dryer of the present invention, these additional protective devices are unnecessary and their function is performed by the pressure switch 16.

This is made possible by the return conduit 18 (Figure 2) draining any overflows from the tank 5 into the pan 13. It is apparent that if an overfill condition of the tank 5 occurs and the volume of the condensation liquid increases due to a drying operation being carried out, the level in the collecting pan 13 will rise causing the pressure switch 16 to be operated and stop the machine. The protection also operates in the event that the tank 5 is not there. In this event, the shut-off valve formed by the element 30 would stay closed and the tank loading pump 14 turn idle and the condensation liquid build up in the pan 13.

It is apparent that to avoid permanent shutdowns of the machine, the programming device which controls the machine operation should include a startup dead time when the pump 14 is operated and any operation of the pressure switch 16 unrecognized, so that, if the tank 5 has been emptied and/or properly placed in its seat, re-start of the machine and the transfer of excess liquid from the pan 13 by pumping into the tank 5 can be allowed. The overfill or near-so condition of the tank 5 may advantageously be revealed to the user, even before the stop condition occurs, by a level indicator suitably provided in the tank.

As shown in Figure 5, the liquid level in the tank may be displayed by means of a conduit 60 formed in the front wall of the tank. The conduit extends through the front template 21 up to the machine front, whereat it is closed by a clear window 61, preferably in the form of a spherical or cylindrical lens.

The foregoing description only covers one preferred embodiment of the invention, but it is evident that many modifications may be made thereunto. For example, where the collecting tank 5 is formed of two half-shells coupled together instead of being a unitary blown piece of a thermoplastic material, the fill and overflow pipes 40 and 45 in Figure 6 may be moulded in with the lower half-shell.

In particular, according to a second embodiment of the invention, the tank 5 could itself function as the cover, detachably hinged to the machine body. This embodiment is shown in Figures 7, 8, 9.

In this case, the tank 5 is quite similar to the one just described and has a top wall 71 which defines the cover upperside and a bottom wall 72 which defines the underside of the inner cover.

The tank is provided, at its rear corner edge (as again referred to the machine conditions of installation and use), with two hinge pins 73 which fit removably in two forked holders 74 formed on the handhole bezel. The tank may be suitably provided, for purely aesthetic

reasons and additionally to a front template 75 for connection to the machine front, with side structures 76, 77 which would rest on the handhole and merge with the side walls of the machine body.

It will be appreciated that the arrangement of the pins and the forked holders could be reversed, with the tank mounting intermesh forks and the handhole bezel mounting hinge pins.

In order to minimize the user's effort to open the cover/removable tank, the hinges may be constructed with a pin pivotable relative to the tank/cover and biased to a rest position by a coil spring and provided with a blade fitting into an intermesh seat.

Figure 9 shows a preferred embodiment of this hinge type.

The tank 5 rear end is provided with two housings, of which one, 78, is shown in Figure 10, each being prismatic in shape and having a C-shaped metal bracket 79 fitted therein which has two parallel wings formed with two coaxial openings 80, 81. A cylindrical pin 82 fits freely rotatable into the opening which is terminated at one end with a circular plate shoulder 83 and a prismatic pin 84.

A coil spring 85 is wound around the pin 82 which has one end 86 engaged in a holding seat 87 formed in the pin 82 and the other end engaged in a holding seat 89 in the bracket 79.

The prismatic pin 84 intermeshes releasably with a plurality of grooves 90 formed by suitable elevations of the handhole, by a vertically upward movement from below. Once intermeshed, the rotation of the tank/cover in the direction of the arrow 91 to move it to the closed position will load the coil spring 85 to counteract the cover weight, which cover will rest gently in the handhole and exert a minimal force thereon, sufficient to open the condensation liquid delivery valving system (Figure 5).

With the cover filled with condensation liquid, the loaded spring facilitates the opening operation, which only requires in practice the mere effort needed to counteract the weight of the condensation liquid in the tank.

Apparently, the coil spring could be replaced with a spiral spring, a torsion bar, or some other equivalent elastic means.

Claims

1. A laundry dryer with a condensation liquid collecting tank (5) and top loading facilities through an openable cover (2) from a machine front (6) by rotation about a rear hinge (3), and through a handhole slip (19) underlying the cover, characterized in that said cover (2) consists of a top wall (27A,71) and a bottom wall (27B,72) connected to each other by peripheral side walls to form a containment volume for said condensation liquid.
2. The laundry dryer of Claim 1, wherein said top (71), bottom (72), and peripheral cover walls form said condensation liquid collecting tank, said cover (2) being hinged removably to said handhole bezel (19).
3. The laundry dryer of Claim 1, wherein said top (27A), bottom (27B), and peripheral cover walls form a pouch housing for said collecting tank (5) which has a front opening (4), said tank (5) being removable from said housing through said front opening (4) by partly swinging said cover (2) open about said hinge (3).
4. The laundry dryer of either Claim 1 or 2 or 3, wherein said tank includes a fill pipe (40) being open through a bottom wall of said tank (59 and extending upwards within said tank and being tightly joined to a condensation liquid delivery conduit (38) within said machine, in the closed position of said cover (2).
5. The dryer of Claim 4, comprising:
 - an overflow pipe (45) open through said bottom wall of the tank and extending upwards within said tank;
 - a gutter (20) collecting overflow from said overflow pipe (45) and being received in a zone of said handhole slip (19) near the machine front (6) and connected by a drain pipe (18,24) to a condensation liquid collecting pan (13) of a condensation circuit (10); and
 - a shut-off valve (28,35,36,37) in said delivery conduit being opened by the thrust exerted by said tank (5) when said cover is in the closed position.
6. The laundry dryer of Claim 5, wherein said cover (27B,72) bottom wall, with said cover closed, depends monotonically from the rear portion of said cover down toward its front portion as far as said overflow collecting gutter (20).
7. The laundry dryer of Claim 5 when appendant to Claim 3, comprising a means (51,52,53,54) of spacing said inner cover bottom wall from a tank bottom wall.
8. The dryer of Claim 7, wherein said means comprises a plurality of ribs formed on at least one of said bottom walls of the inner cover and the tank.
9. The dryer of Claim 7, wherein said means comprises two expansion wings (51,52) of said tank (5) and two bearing guides (53,54) of said wings set in said cover (2).
10. The laundry dryer of the preceding claims, wherein an access door (41) to a drying drum (31) of said

dryer is provided with a resilient sealing gasket (34).

11. The dryer of the preceding claims, wherein said tank includes an overfill display conduit (60) in communication with said volume to contain liquid and extending to a clear level viewing window (61) exposed on a front edge of said cover. 5
12. The dryer of Claim 2, comprising a pair of cylindrical pins (82) mounted rotatably in said cover (2) or said handhole bezel (19), respectively, and being each provided with a removable prismatic pin (84) fitting in a corresponding rebate (90) on said handhole bezel (19) or said cover (2), respectively, an elastic means (85) being associated with said pins for applying a torque to said pins, whereby said pins can be rotated relative to a predetermined angular position respectively of said cover or said handhole bezel. 10 15 20

25

30

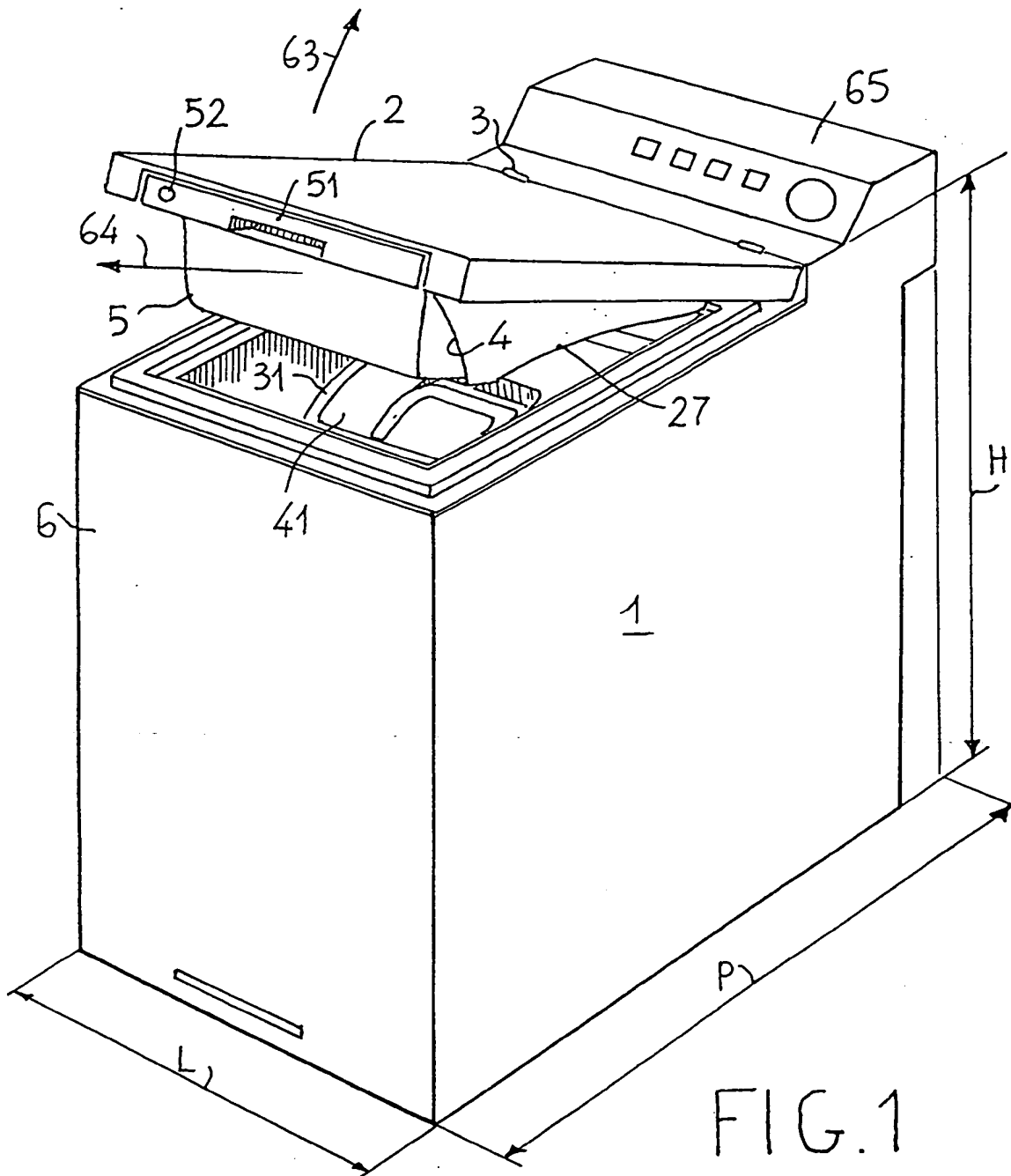
35

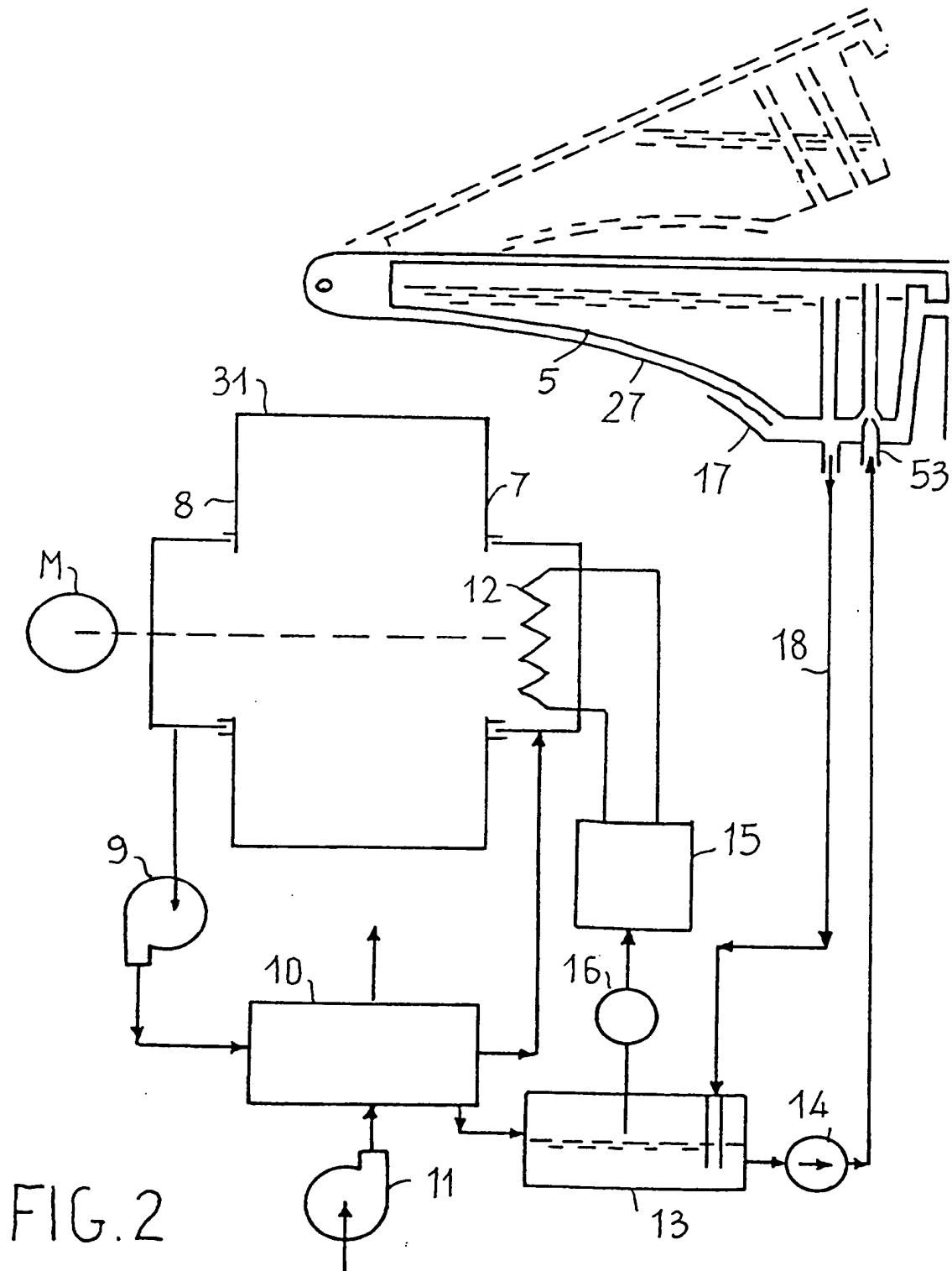
40

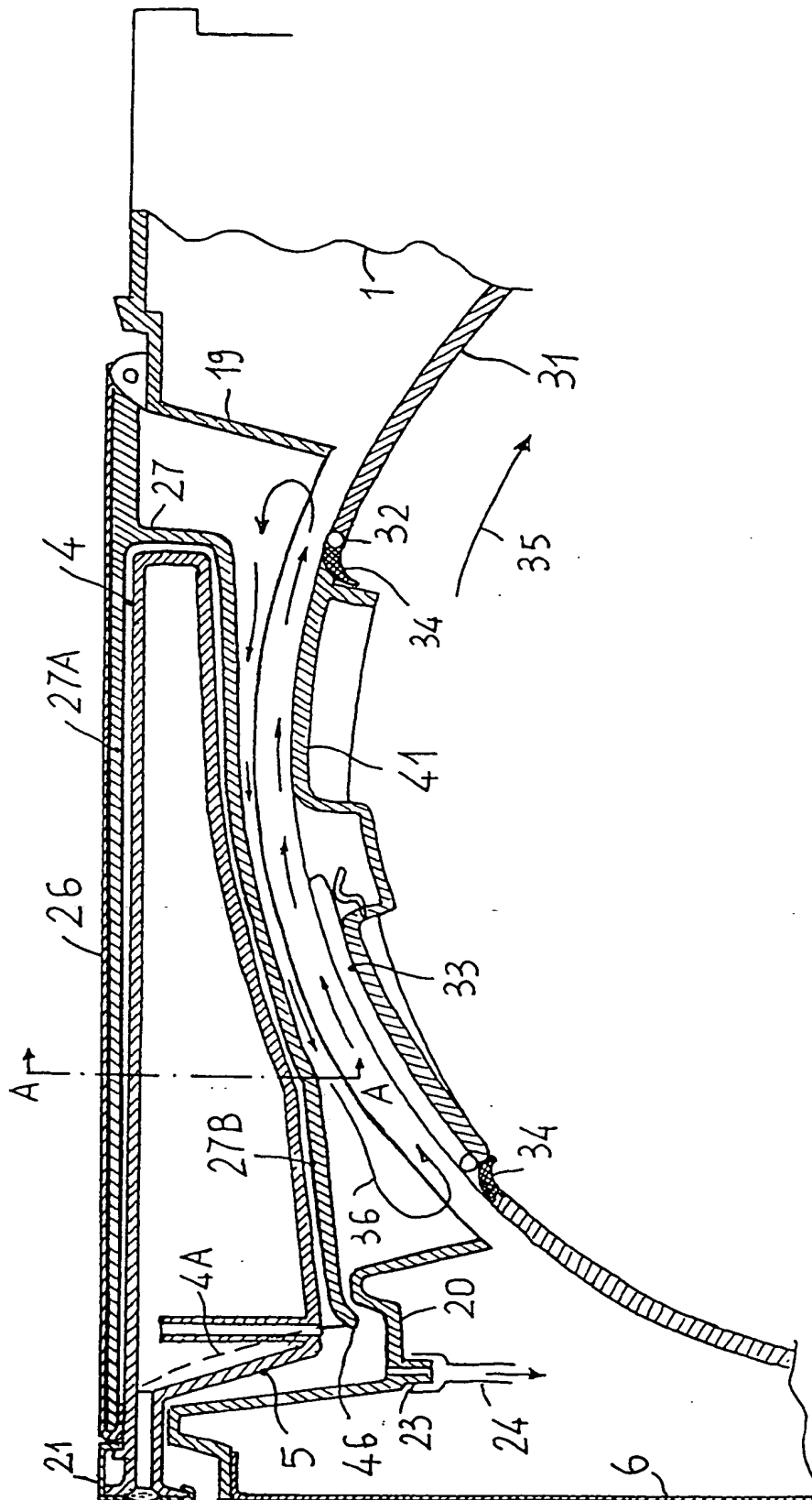
45

50

55







FG.3

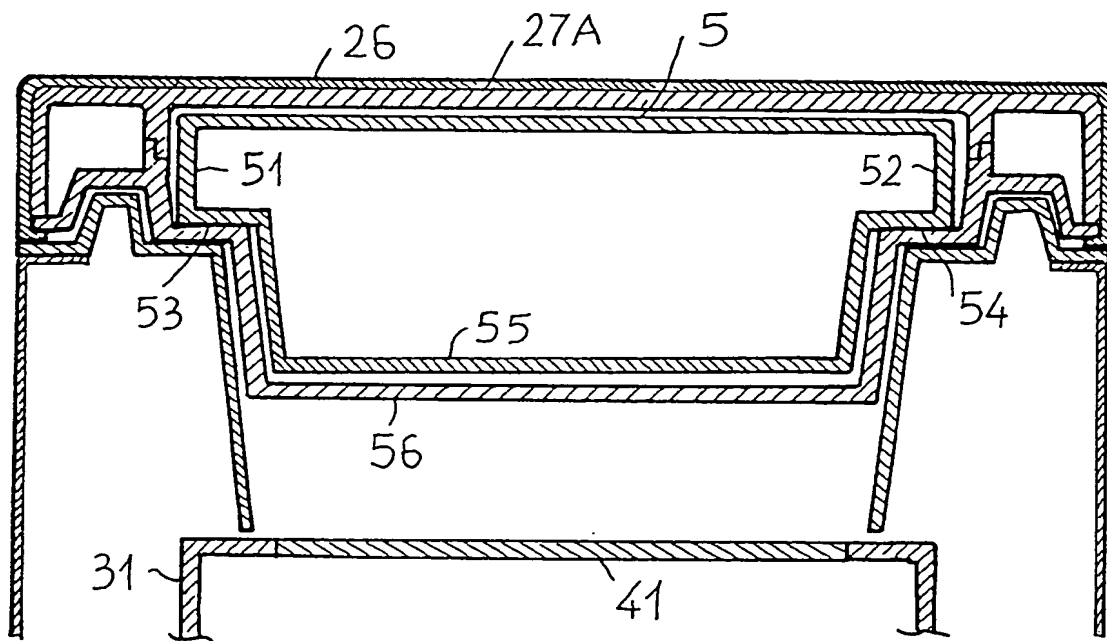


FIG. 4

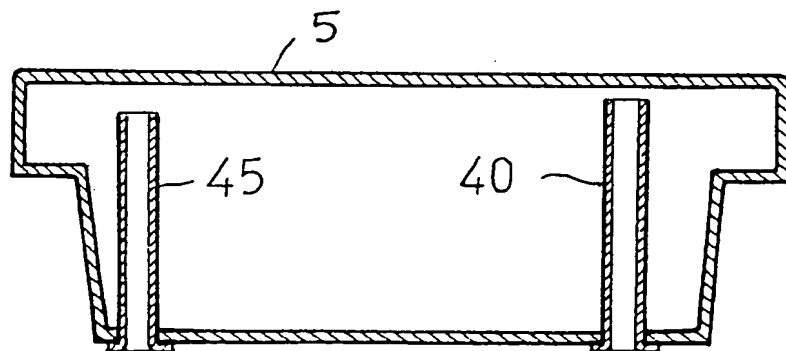
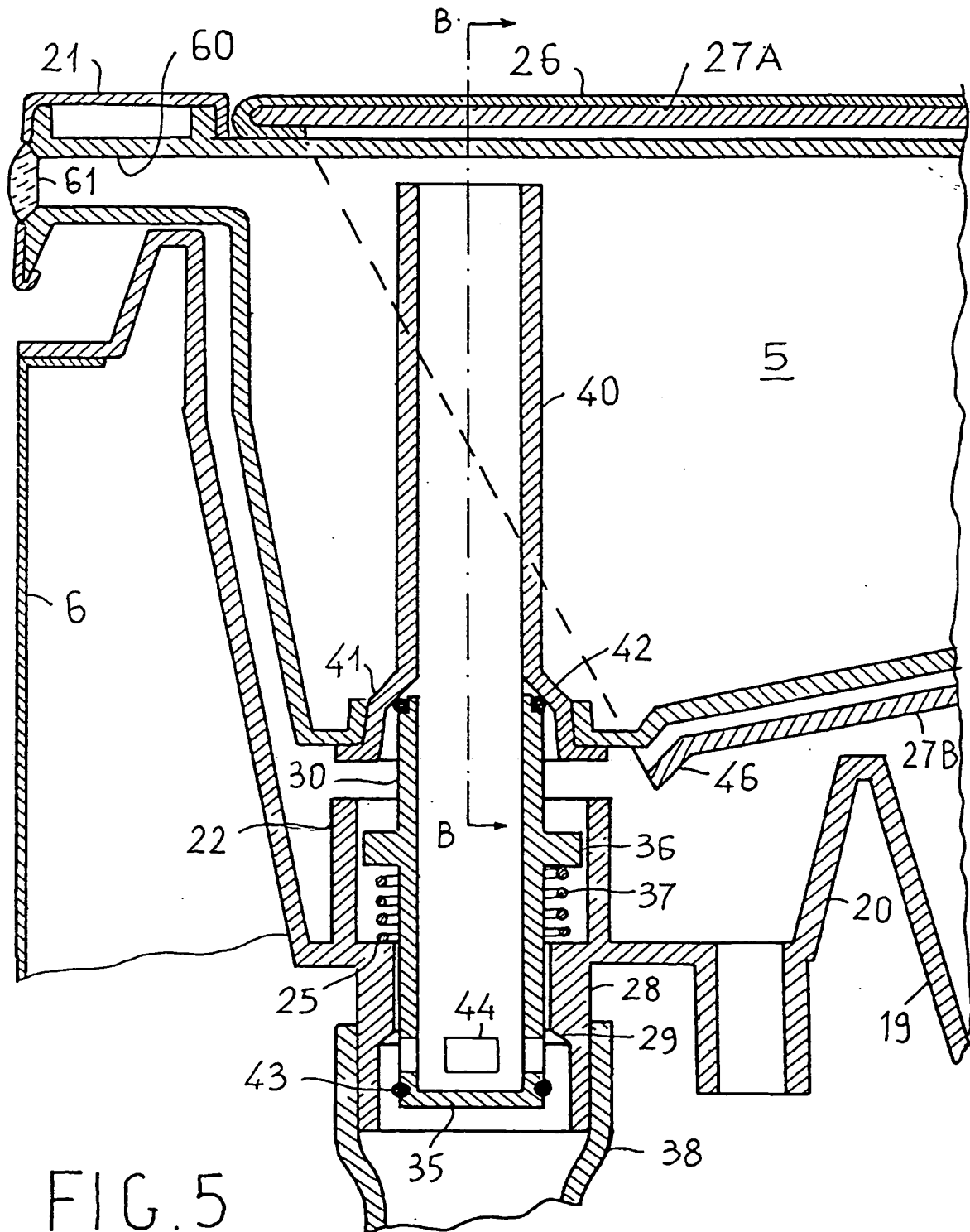
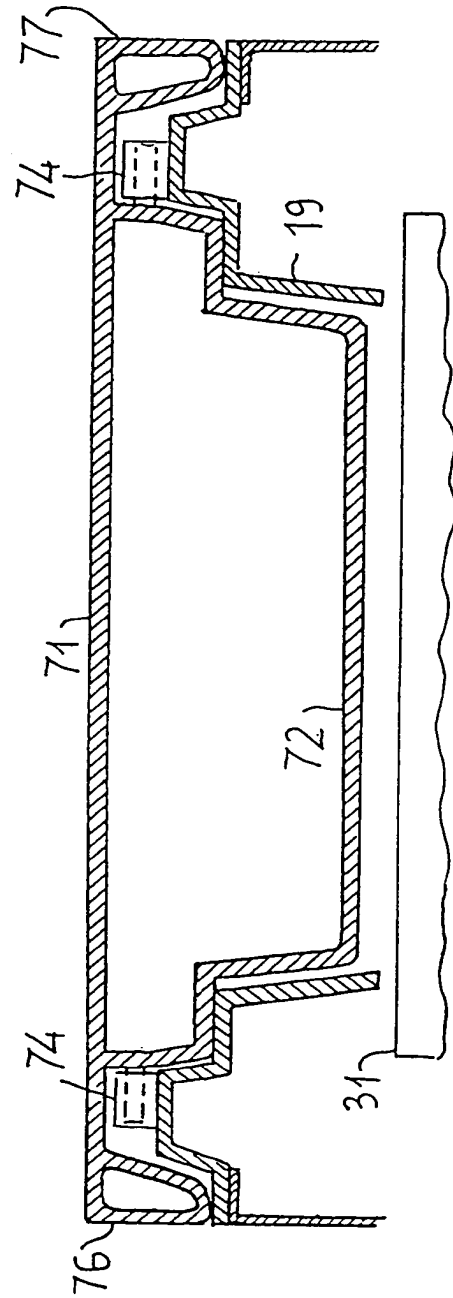
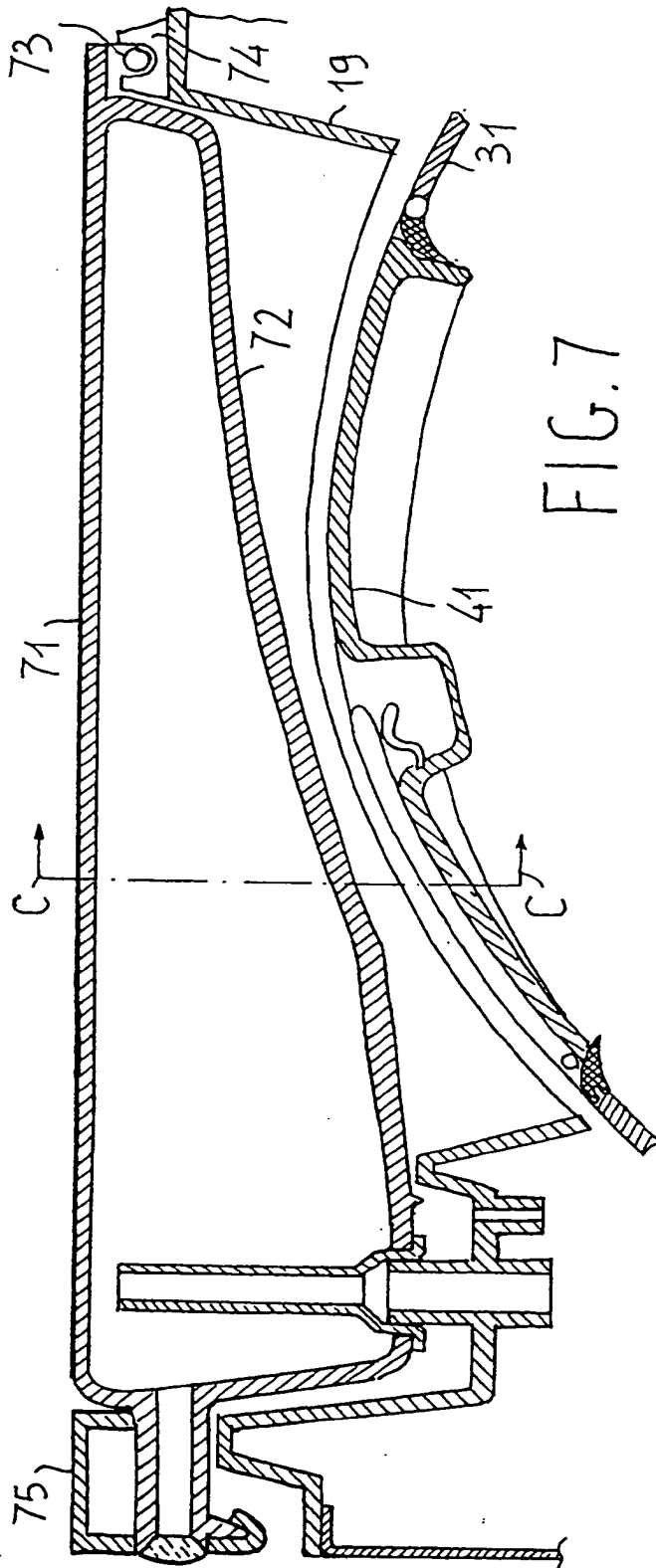


FIG. 6





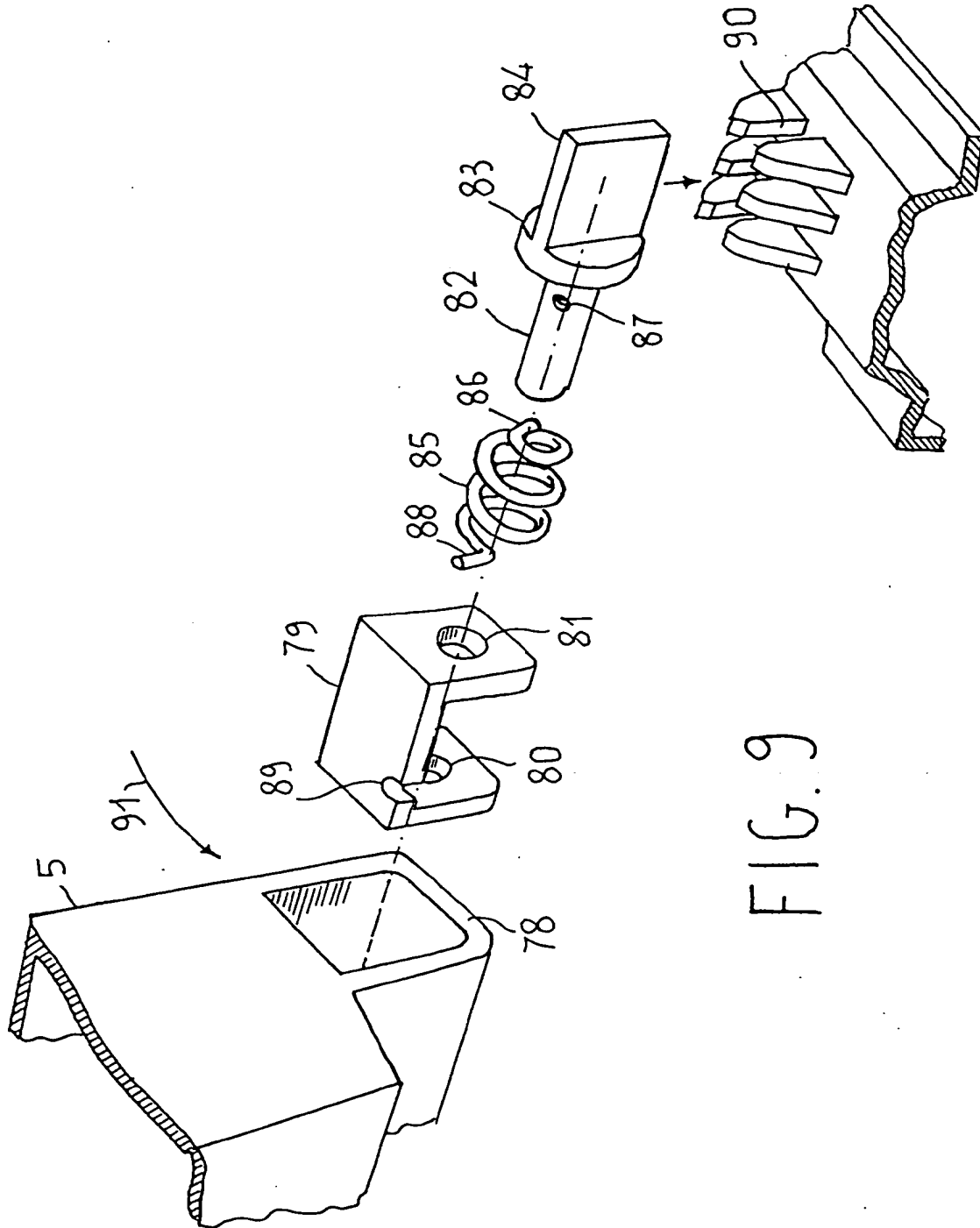


FIG. 9



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 20 2389

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	EP-A-0 484 225 (CIAPEM) * claims; figures *	1,10 3,4,6	D06F58/24 D06F39/14
A	GB-A-2 115 127 (BOSCH-SIEMENS HAUSGERÄTE GMBH) * page 2, line 23 - line 91; figure 1 *	1,5	
A	DE-A-29 33 513 (MIELE & CIE GMBH) * claims; figures *	1,5	
A	DE-A-37 08 516 (BOSCH-SIEMENS HAUSGERÄTE GMBH) * abstract; figures *	1,11	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			D06F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10 June 1996	Examiner Courrier, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure F : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 150 (3.12.1994) (P4/C01)